Modern Web Designs Using Adaptive Content Delivery

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ABSTRACT

The intention of this study is to investigate how Modern websites are efficiently delivering information from the servers to their clients and its problems that are impacting the society today. People spend most of the time of the day surfing the Internet from various access devices i.e. desktop, laptop, mobile phone, tablet PC, watches, etc. The daily numbers of devices are increasing and so is the network traffic. Maximum of times the issue is related to bandwidth, especially as the device's size decreases can compel the developers and designer to take drastic measure to provide optimum experience. This study highlights on how various different sectors of technologies are trying to solve the issues with their patent technologies, still, there exists a gulf of standard means information and data transfer. One sound solution that has been standardizing is content delivery networks (CDN). The CDNs have solved many problems related to network traffic distribution & latency but require a generation update. This study discusses some of major design patterns and workarounds that developers and designers can adopt in order to provide better user experiences. This study will propose a solution that will solve some of the problem related to intelligent data transfers across various client devices.

Keywords: Web design, CDN, Adaptive web, Responsive web, Styling.

1. INTRODUCTION

In the last ten years of web engineering the talk for adaptive and responsive Web design has taken over the web by storm. Every major corporation is looking forward to representing their web design to reflect the guidelines of adaptive and responsive web design. It's a question that many need to ask and find the reason whether why this ideology is being adopted and why it has become the latest trend. Adaptive and responsive Web design helps its user to access information in a format, which is easy for them to use more user-friendly.

The usage of desktop computers and smart devices has increased in past few years; one of the main reasons is the Internet. The Internet along with the modern smart devices have made it possible for new communication tools and expanded media, services and manufacturing industries technologies [1]. The data sources on the Web are growing day by day, according to [2] 80% of the Internet users are using some sort of mobile devices to access the content online. The numbers are increasing on a daily basis such that just in the Quarter 1 (Q1) of 2015 the Web has served 10% more than 2014 complete year stats [3]. With such a boom in the technology and the boom is rapid enough it is still a question that what next? The new trending gadgets like watches, arm bands glasses soon there will be ubiquitous computing everywhere.

It has become important for us to come up with a sound solution that will allow us to transfer the data to devices efficiently. A designer today faces the same issue while designing their Website and so are the users who access it through different networks whether it is over LAN, Wi-Fi or Mobile network. Sometimes the Website is designed in such a way that large sized media resources often fail to render on mobile devices and hence we mostly compromise the User Experience (UX) and user satisfaction. Over the course of time, there are many techniques the developers are adopting to overcome the issue of rendering media resources efficiently. But yet there exists no sound method which helps users to render the Web resources smartly.

Also, there isn't exist any unique system that provides a smart user interface for querying all necessary data and makes simple on interaction to the end users. This raises a need to visualize Web data and provides data on any kind of mobile devices screens effectively. This study will present existing techniques of Adaptive Web Design, Responsive Web Design and Content Delivery Network (CDN) and then try to lay a foundation of a simple framework that will help the developers to use existing resources so render efficient media resources on all browsers. This solution will not only be intended to images but if further researched it can lead to a complete media solution for desktops, mobile devices or any other upcoming technology. This mechanism can adapt to produce effective layouts by rendering important.

1.1 Adaptive web design

According to [4] Adaptive Web design is a designing technique, which changes its organization and presentation on the basis of user navigation patterns. Adaptive Web design is a method for loading Website, which uses both server tags and client information to render required information based on the user's device. It is often confused with the term responsive Web design but there is a wide quite a difference between both techniques. In Adaptive Web design technique, altogether a separate Website is designed with providing a limitation to devise capabilities.

In the examples of the adaptive Website, we have apple.com, yahoo.com, amazon.com, facebook.com, avenue32.com and much more. These all above-mentioned sites all load a different Website on a mobile device and a desktop PC. The requirement may be different on why many are still sticking to the traditional Web designs, but one common solution to that this design solves is satisfying a range of users, which are increasing on a daily basis as explained by [3]. The Web design allows its users to render only those elements on their device, which are meant for the device and not generic content but here the disadvantage comes i.e. the overhead of designing multiple sites with duplication of content that needs to be designed by the designers. Figure 1 is a visual representation of how Adaptive Web designs works.
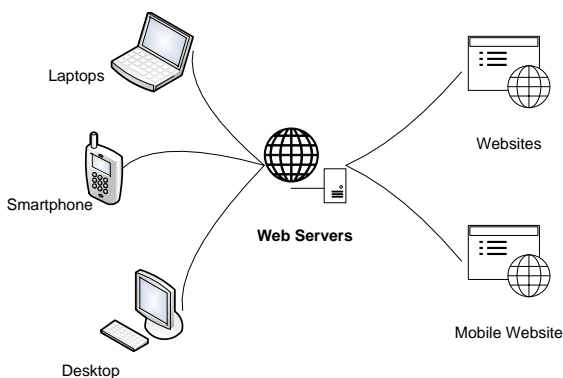

Figure 1. How websites render in adaptive web design schema

1.2 Responsive websites

L. Wroblewski [5] in his talk titled "One design to rule them all" in 2013 explains the importance and reason for what the responsive Web design. The title explained the term what responsive is all about. In this kind of design, the Website is designed with one layout in mind and then on the basis of different breakpoints (i.e. screen resolution sizes) the Web layout is re-structured. This is a more modern approach to Web design and many modern Websites like Microsoft.com, Cnn.com, BBC.com, Disney.com and much more.

The biggest plus point that this method is becoming common among designers is that Google the Search engine tech giant recommends responsive web design pattern [6]. The reason that google provides is that responsive Web design provides Search Engine Optimization (SEO) friendlier Web pages. The URL as well as the content remains the same across all platforms. It becomes easier for google crawler to crawl data faster.

Responsive design has three major elements that work at its heart i.e. Fluid grids, flexible images and media queries [7]. Figure 2 below is a visual representation of how Responsive Web Design works.
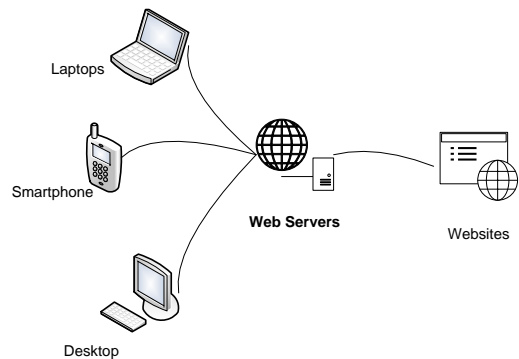

Figure 2. How websites render in responsive web design

1.3 Content delivery networks (CDN)

A content delivery networks (CDNs) are collection of a largely dispersed network of servers across the geographical region. It provides optimization tools that enable users to rapidly deploy & spread data across multiple regions [8] Content delivery network is not a new concept. Figure 3 explains the abstraction of how Content Delivery Networks differs from ordinary delivery networks.
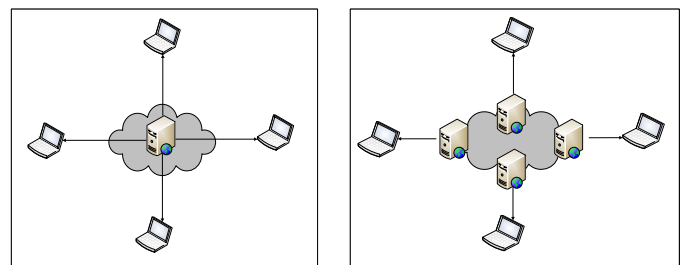

Figure 3. Traditional delivery networks vs Content Delivery Networks (CDNs)

Content Delivery Networks are often mistaken as a technology that helps us only in managing media objects. But in reality, these are a way superior concept. According to [8], Content Delivery Networks have three major use cases, which are Application Optimization engine, file replication, unlimited bandwidth source.

1.3.1 Application optimization engine

Application developed for the Web, desktop and mobile need to be accessed from different locations such could be the case with multi-national companies. These companies need their applications to function at its best, where they may be located in any part of the world. Content Delivery Networks helps them by replicating their application on various Locales and on accessing the network the traffic is directed to the nearest possible Server. Content Delivery Networks also provides a separate Application acceleration protocols by optimizing TCP calls [8].

1.3.2 File Replication

Companies having a global presence will have a large set of databases located in the locales or geospatial area and when one need to communicate with the data from the other locales the data could take a long time in retrieval. However, a Content Delivery Networks helps with such solution to replicate the data from different locales and clones them to the others. It becomes easier for the companies to stay connected to each other. The problem in the above case has already solved by DBMS. Every data that needs to get replicated needs a certain medium of communication so by providing them with a sound method of proper replication mechanism to reduce the cost of bandwidth usage is the work of Content Delivery Networks. One more scenario according to [8] is that the use of media files like office documents that need to be accessed by colleagues over different locations Content Delivery Networks could save the bandwidth usage by replicating the files to servers on different locations

1.3.3 Unlimited Bandwidth Source

In an environment, where the data usage is dense, the rate at which data being used is increasing rapidly and the data consumption is unclear, a Content Delivery Networks are often used to ensure that the application or service remains responsive no matter how high the request volume becomes. Each of these use cases utilizes the Content Delivery Networks to address a perceived problem with the organization's existing infrastructure [8].

1.4 Literature review

This section will discuss practical applications of above two major design fields and try to examine them in terms of their performance, UX and why did the developer switch from the traditional Web design. The review is made in the term of some common factors such as UX, Images, page speed, server request, and responses. The common ground that every developer and designer will agree is that a perfect design is nearly impossible to accomplish because we cannot satisfy the user needs.

1.4.1 The adaptive web design experience

Adaptive web design uses progressive enhancements technique [9], which allows the user the layer based experience rather than "one design to rule them all" [5]. Progressive enhancements are all about crafting experiences that serve your users by giving them access to content without technological restrictions [9].

Brad Frost at Future Insights [10] Live gave a talk about Anatomy of Adaptive Web design, where he makes a distinguished statement that responsive Web is just a tip of the iceberg of a complete process for achieving the user experience. He later explains that Responsive Web design is a small portion of Adaptive Web design, which is a complete package of different systems combined. He later pointed out few principles of adaptive Web design, which he mentioned are Ubiquity, Flexibility, Performance, Enhancements, and Future friendly. The following are a brief explanation of each

1.4.2 Ubiquity

The future face of the majority of devices will be controlled via Web interface [10]. The Web which is not an ancient technology has taken a complete overhaul in the last five to ten years. Since 1990 when Tim Berners-Lee deployed his first prototype of Web based Website [11] was based all on hyper textual information. The Web was started as a text

based project, unlike today we are now using more and more of modern days' media elements such as Images, sounds, and videos in it. The applications and projects that were based on a simple desktop are now slowly shifting towards modern Web based solutions. The textual information was also viewed on a single desktop computer, which in itself was not an impressive user experience. The Web of today is taking over every device that we hold today from our desktop to phones, tablets, laptops, gaming consoles, phablets, and the future is coming where the Web interfaces will be deployed on Internet of Things (IoT) devices. The content of the web experience should be consistent over cross devices i.e. provide the user what is necessary to them on a particular device. According to [10], there are certain factors that should be considered before they get published to device platforms; and these are quantitative and qualitative.

1.4.3 Some Quantitative Factors

(1) Use either SI (MKS) or CGS as primary units. (SI units are encouraged.) English units may be used as secondary units (in parentheses). An exception would be the use of English units as identifiers in trade, such as "3.5-inch disk drive"

(2) Screen sizes: how big or how small the screen size, how many depths per inch pixel certain device holds, where the screen is viewed on a desktop or phone device?

(3) Connectivity: factors on whether what a user is using to connect to a website i.e. mobile network or over a broadband, DSL or Dial-up

(4) Device capabilities: This explains what the device can do and how much can it deliver in terms of its hardware?

(5) Processing power: When it comes to hardware the very first thing for every device is how much processing a certain device can withhold?

(6) Input methods: a user may use touch screens, keyboard and mouse, virtual reality headsets, augmented reality motion detectors and etc.

1.4.4 Some Qualitative Factors

(1) User goals: what does the user want to achieve by accessing a particular Website?

(2) User environment: where a user accesses the Website i.e. whether indoors or outdoors?

(3) User attention: What is the user's attention span?

(4) User capabilities: how much capable is the user regarding usage of computer devices and how much the user familiarized with jargons in terms of using the system?

1.4.5 Flexibility

With diverse screen sizes and different models of networks the user, sometimes faces limitations of content. Such content may be available if the user tries to access it over the desktop. Adaptability of web design focuses on a flexible design, which will not allow its users to limit its content but rather be flexible to show the right content. Not to compare it with a

Common Device Resolutions (Pixels)

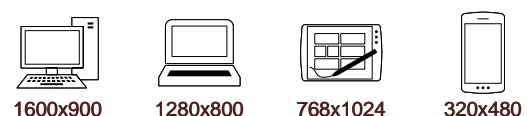1600x900   1280x800   768x1024   320x480

Figure 4. Conceptual diagram of present device resolutions

responsible designing technique, which we will explain in detail in the later part of the paper. According to [10], the flexibility might have inspired the field of responsive web design. Flexibility focuses on user satisfaction in all factors but most of all it should be future oriented too i.e. if a new resource arises then the web design should accommodate it.

1.4.6 Performance

According to [10] research says that 79 % of Web users leave the Web page if it doesn't get loaded with certain page time limit. Page size according to statistics on average page size for any Website should not exceed 1.3 MB. Performance has become one of the most important parts of all Websites. Google in its ranking algorithm considers the performance as one of the most important things i.e. faster sites leads to happier customer satisfaction. According to [10], an average user loses its interest on a Website within 5 seconds. It is developer's responsibility to design it in a way which is performance enhanced for each device.

"Performance as Design -> Performance Is Design"

Facebook's mobile Website was in its early years was one of the slowest applications. They had to redesign the whole application just because their design failed due to performance issues. Similarly, twitter had cons in which for every request they had to load the whole page giving them a bad user experience. It could have been achieved with a simple by refreshing the required content then there was no point in loading the whole Web page the elements are unnecessary it should be minimized

1.4.7 Future Friendly

As we have discussed in ubiquitous principle that Web is everywhere and all interfaces on devices will be using the Web based interface. But we have to considerate that there is no such thing is future proof work. Because it cannot be predicted to which new device is going to come and coming with what technology. According to [10] one way adaptability can affect the Website is by using extension/ add-ons on the browsers to change the behavior of the Website. With this method, it can be future proofed but this is not an ultimate solution and we still need to find right method to make our Web design future friendly. Apple still sticks to the adaptive Web experience as amazon, USA Today, Avenue 32, and About.com [12]. Adaptive design is a good solution for device oriented design that may save user bandwidth consumption but it comes with a developer overhead and resources overhead of redesigning the content for multiple screens and exporting a single resource multiple times with different properties

1.5 The Responsive web design experience

Responsive design can be summed up with a one line word "one design rules them all" [5]. The Term Responsive design was coined by Ethan Marcotte in his popular book "Responsive Web Design", which discusses in depth about why responsive technologies will take power and so will the Web designs. According to [13], Ethan mentions three major ingredients of responsive Web design. They are shown in figure 5 and mentioned below:
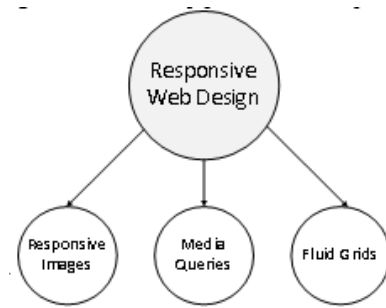

Figure 5. Responsive web design principles [13]

1.5.1 Fluid grids

It is a grid system which has the property of fluids [14] i.e. it flows with what shape is provided to it (in terms of screen resolution). Unlike the traditional table-based design, which compelled its user to stick to a design pattern that is followed by urban map designer i.e. each column and row show have same height and width. The fluid grids are rather more flexible in nature. The Websites used to look like a periodic table rather than a marketing tool. Fluid grids provide an excellent framework for displaying the content on the Web across all devices considerably. The fluid grid system focuses on the approach of relatively assigning values to its object rather than fixed with. For e.g. the typography is

- With fluid grids, we need to modify the content to display it accurately
- Set the font-size 100%; usually the browser set text default text as 16px;
- We can calculate the flexible typography with a simple formula of Target size / 16px (where 16px is the standard font size of the web).
- Margin and Paddings

Grid systems are there on the Websites in order to support the responsive nature of them. Some famous frameworks that provide fluids are Skeleton, Neat (Bourbon), Simple Grid, CssWizardry-grid and much more to expect in future as the responsive nature of the Web becomes common. Not be mistaken by the front-end UI, the fluid grid is a part of a responsive framework which includes complete front end tool with responsive tags for images and media queries. Front end UI framework composes of many elements that include model, views and controller's concepts i.e. in simple terms grids, behaviors, and the User Interface.

1.5.2 Flexible Images / Responsive Images

We can wrap up the definition for flexible images or responsive images with this statement.

"max-width: 100% (CSS style taxonomy)"

According to [15] responsive images provides the developer the flexibility to post images on the Web with visual harmony. Images that changes sizes on basis of screen resolution defines this term.

1.5.3 Media queries

Media query helps the browser to select appropriate style attributes on basis of client device type and its resolutions. According to [7] the W3C classified media as a part of CSS3 description, improving upon the potential of media types. A media query allows users to not only use device classes but also to target not only certain device classes but to actually

examine the physical characteristics of the device rendering our work.

1.6 Responsive vs adaptive web performance

In the web world speed is everything; even a split second can drop sales. According to [16] the 5 second theory the developers are working on many different methods. Table 1 below shows the difference between responsive and adaptive Web design.

Table 1. Basic difference between responsive & adaptive web design

Responsive Web Design (RWD)	Adaptive Web Design (AWD)
Google recommends it. As single page is used to capture the traffic	Optimization technique needs to be implemented for effective Search Engine Optimization (SEO) e.g. canonical URLS
One time design which gets deploys on all devices	Needs different designs for different applications
Often results in the rendering of web pages in mismanaged manner.	Optimized for the different devices
Future design oriented	Lacks future design orientation
Design time and process is reduced	It takes more time to design adaptive experiences
Can be used via Content Delivery Networks (CDNs)	Can be used via Content Delivery Networks (CDNs)
Uses responsive image technique to render photos	Single image resource with multiple instances is maintained.
Still requires an optimum solution for resolving content delivery	Resource management may have been resolved but requires a better solution for content delivery

According to [17] As Stuart McMillan writes, "this ability to switch content (templates) based on server-side device detection is the heart of adaptive design." Or to make a garment analogy: if responsive Web design is like spandex, stretching to fit any body type, and native apps are like custom-tailored couture that fits only a specific individual, AWD is like having a massive wardrobe of easily interchangeable pieces in all shapes and sizes ready to complete an outfit. The following diagram can distinguish between the main difference between the adaptive and responsive approaches. Figures 6 and 7 shows the basic difference between Adaptive Web and Responsive Web designs.

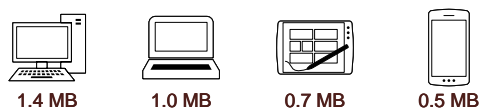**Figure 6.** Responsive web experience [17]

Figure 7. Adaptive web experience [17]

2. MATERIAL AND METHODS

2.1 The understanding requirement for next-generation Content Delivery Networks (CDNs)?

The art of communicating with clients through the Internet has enlarged massively in complexity and difficulty. There seems to be no constant except for change. Individuals now access Websites via desktop computers, tablets, laptops, phones, and wearables, via connections that range from fast to agonizingly slow. They may seek general or specific information, based on immediate or future needs. They may experts of technology or amateur smartphone users. The time factor has also come into effect i.e. the attention spans and patience among the users continue to shrink as the expectations wait for fast experiences. Clients are evolving to portable techs to assist them in transactions that lead them from early purchase to post-sales engagement. In response, companies have always looked for an optimum solution to deliver information to their clients in an organized way, challenging technical issues like connection speed, device memory, and screen estate. Consumers today are seeing various ways of data representation including digital storefronts and digital media. These have embraced a variety of iterations, including the mobile m-dot site, the native app, and Responsive Web Design (RWD). Each of these provides degrees of functionality and comes with incumbent limitations. The latest of these popular iterations is a new approach called Adaptive Web Design (AWD) [17].

In the following section, the study will discuss some common practices that the developers and the technology use in order to provide a better user experience over various devices that may reside on various networks. It will also point out the direction to how the CDN of today resolves the issues and why it is becoming necessary to adapt a newer version of CDN i.e. Responsive and Adaptive Content Delivery Networks (CDNs).

2.2 Challenges faced by the average CDN

2.2.1 Kind of devices user may use

Before Content Delivery Networks deliver any content to its consumer, they should know what kind of clients are requesting a certain data and how i.e. which devices are they using, what network resource they have requested from? One misconception that developers had while building Websites were that user will only turn to mobile devices to access a site when they had no other option to access it [17]. Today people despise using the computers and cherish the fact that they like to view content on their portable devices. The maximum level of users is using portable devices to access the Websites (i.e. Laptops, Tablets, Phablets, Phones, Other media devices). They are relying on their portable devices mainly phones for browsing, window shopping, and purchasing more than ever, but they haven't completely abandoned the desktop

environment. The desktop experience must remain top-notch, and the mobile involvement must be built in order to match the functionality, design, and performance of both devices.

Yet another concern is based on contextual information – determining and delivering what the client will want at any given moment. Will they want a complete catalog or a sub section of certain data? What will the user react at a certain moment when the content is provided to them? Contextual based problem is more oriented towards the designing and developing part of the project. However, the context can be considered from the point of view that what data format of data needs to be at what bandwidth.

2.2.2   Current applications: The M-Dot Site

This is a branch of adaptive Web designing [17]. The content is designed specifically for the mobile devices and the information architecture of the projects is designed in a way that the most important data is presented to the user. This is done in order to maintain optimum experience. However, this technique may be the best way we can tackle usability of websites but it come with the overhead of content that may be of medium or least important may slip away. The experience may suffer due to a different kind of information display.

In order to understand what the user might face in today's world of portable devices, we need to see where it all started at. This will not only make the readers understand the requirement of a newer Content Delivery Networks but also helps to clarify some of the overlapping terminologies that dominate this space.

According to [17] at the beginning of the smartphone era, the majority of Websites had no mobile-specific deployments. The desktop layout was simply replicated at a smaller scale for mobile users. There was little option for such are a requirement. But those who used the mobile web frequently grew frustrated as they struggled to view elements like large graphics, which were clearly designed for much larger screens. If the user accessed the Website with GSM or any of the G networks firstly it was really slow because of the amount of the user request it uses to send, secondly the bandwidth utilization use to be really high that led the user balance to exhaust with only one-page load. These issues gave birth too many techniques, among some, are discussed in the later part of this document. The design issues included such as forms and drop-down selection menus meant for full-size cursors, rollers, button presses and the absence of touches. The user uses to get frustrated with excessive of pinching and scrolling which at a maximum time leads to dissatisfaction and site abandonment. The Website at this situation is only used as a necessity and requirement rather than an ease of use.

Later mobile industries evolution started to play a greater role in consumer's culture –after the release of the smartphones in 2007 – mobile-specific Web solutions were developed. One way to overcome the issue of mobile based Websites was to build separate, mobile-specific versions of a Website, or using the m-dot sub-domains rather than 'www'. This is still an early and somewhat unpolished effort, as it involved developing and maintaining two or three separate versions of Web apps in a single code bank to have the correct one ready for the receiving mobile device [17].

With the solution of m-dot sites, there were many other problems that arose like maintenance overhead. Even designers and developers had to redesign the user experience based on the device; as a result, there was inconsistency among the various versions. The results for m-dot sites were that they had rearranged and simplified navigation structure

and limited access to content when compared with their desktop counterparts [17].

2.2.3   Current applications: The native mobile experience

Let's try to distinguish what actually is a native mobile Experience. Smartphone's today is a pocket computer rather than a device for phone, mobile phones are used for other than phone calls according to [18] 54% use of mobile phone is for other engagements and the 46% is also not used for solely for calling but rather SMS, email & calling as shown in figure 8 below.
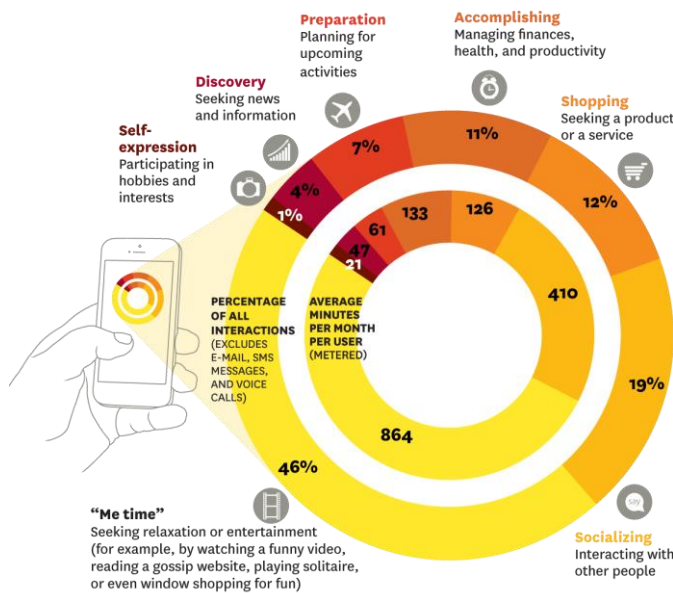

Figure 8. How phone devices are used [18]

There are many countries in which the Smartphone that were sold and functioning outnumbers the total population [17]. "There's an app for that." became famous in the portable devices era. Native Mobile apps are comparatively easy to build and the main focus is on a finite set of tasks. These are easily deployable.

Every company needs an application to market its position. Even companies with no commercial interest use the native mobile experience to allow its user a better and friendlier space to explore with. Let's take an example of an airline business; it can serve its customers by offering a smartphone app that permits early check-in, confirmation of departure time, and changing of the seat. This information can be shared via the Website but the native experience gives the users a sense of security and a better experience. Here the tasks are highly specific of nature, localized actions which are performed by individuals for the moment; this is what the customer wants and needs. According to [17] Native, mobile Experience enriches with features like push notifications and promotional material and can deliver added value by integrating with a phone and its features, such as camera, a location sensor, and the accelerometer. This format might be the best option for the user to provide an experience which might not be powered entirely by Content Delivery Networks, but rather requires less amount of data transfers as the majority of the content is within the application. Native mobile development has its number of challenges.

According to [17], there are certain challenges that developers face. It is easy for the developer to create and deploy an app with cross-platform development device frameworks has device compatibility issues. Each separate

app is required for each mobile platform (Android, iOS, BlackBerry & others), with the overhead of continuous maintenance. Even for smaller updates, the developer has to deploy the app at wide scale and the user has to perform the whole process of reinstalling the application. They take up space; most commonly user might use the application once or twice and then forget about it, and can make the phone's performance inefficient. The developer has to deploy the app is another crucial problem where they have to take the extra step of deploying it to an app store for a download. There are exceptions where the user may use this solution as the best and only option like Google, Facebook, YouTube and some other social media applications, where the user needs a faster access to the information and it is again and again. But using this for everyday details and information spreading of a corporation is a major headache for both the user and developer. It's a solution but with its challenges such as slow adoption and low in-app engagement, although the fact the development in this is cost inefficient.

2.2.4 Current applications: Context-based

Until the browsers get smart the developers will always look toward proxy techniques on implementing intelligent content delivery. Currently, the browsers leverage only the following information to the servers i.e. figure 9 shows the current user agent request header.

> User-Agent: Mozilla/5.0 (iPhone; U; CPU iPhone OS 4_0 like Mac OS X; en-us) AppleWebKit/532.9 (KHTML, like Gecko) Version/4.0.5 Mobile/8A293 Safari/6531.22.7

Figure 9. Current browser header request for resources

The above information shows that the Website was accessed by an iPhone with OS 4 and it is using a safari browser. Using the information, the browser gives us helps us decide what method to choose from. However, there are still loopholes in the current methods. Currently, the industry is applying many techniques to provide a solution for better content delivery of images and resources, among them there is three major kinds of content selection techniques for better data delivery across different networks. These techniques are discussed as following:

1) Adaptive design

Is the optimum solution for content delivery, but it comes with the overhead for the developers as they need to design & develop the same resource multiple times.

2) Implementing Client-Side scripting

Client side script is a lightweight option, where the user includes certain libraries at the beginning of the document to decide whether what resource to deliver or choose the appropriate file based on the browser capabilities. However, there are issues such as the disabling the JavaScript or if the script code doesn't get delivered the whole Web experience is broken.

3) The API Solution

Services like whatismybrowser.com provide API that gives the developer the necessary information for parsing the right information.

4) SrcSet technique

This is a bypass solution rather than a concrete solution as it is an application on the responsive design side. According to [19] SRCSET technique is google way of solving the problem of content delivery. In this technique img tag's capabilities is enhanced with some additional attribute added

to it, these attributes hold the information regarding the images and what image to load at what resolution particular resolution. The solution of presenting the right image resource to it users at different devices might be the optimum solution to the content delivery.

Later google themselves defined another technique to enhance the SRCSET area with the inclusion of another tag named Picture Tag. This tag holds the information of which image to load at what device and the browser will decide on which resource to choose. This method uses a technique called Art Direction, which helps to render the image properly on the devices. The drawback to this technology is that it is supported only in few browsers right now. The major problem in this technique is that the content is delivery is again based on the users in defining multiple resources even though the responsive design is "one design which rule them all" [5]. The solution still is required in which a method is required the source may be rendered via a delivery network but the how is will be visualized can be used via art direction technique.

3. RESULT AND FINDINGS

All the above-explained challenges have one thing in common. They all are revolving around one issue to resolve the content delivery and defining various techniques for it. However, the solution the industry requires is a way in which the Content Delivery Network (CDN) and the server should decide what resource to send the user on the request of users and how is it displayed on the page is what developer can handle. With this technique, we will get a powerful edge on how to store single resources on the server and let the server resolve what content to be delivered.

This is not something new; this technique can be seen highly popular video streams where the video changes its resolution and quality on basis of user network speed. The very famous Website youtube.com allows the user to select the version of the video to render but intellectually selects the resource for them the content is then delivered on basis of whatever bandwidth the user uses, this situation is shown in figure 10 below.
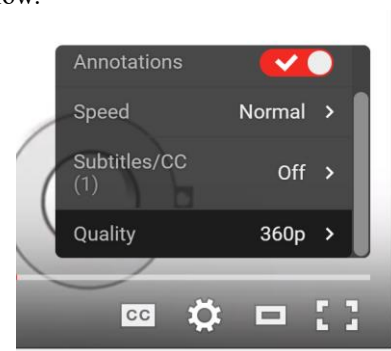

Figure 10. Youtube's video quality selection

All major video streaming Websites use HTTP bandwidth streaming algorithms. But the problem with these methods is that they are using the client-side scripting to resolve the issue explained in above section.

3.1 User-agent based solution

The current solution is based on proxy techniques that implementer's uses in their own way. It's about time that a

solution is required, where the browser is given the ability to send in the right information of its user's and their bandwidth. On breaking down the header, already shown in Figure 9 above; it can be concluded that has information that was effective for the previous generation of the Web but today we need more than just a few user header information. A solution that we propose is to enhance the header information and add few more Meta information. It can be constructed from table 2.

Table 2. Suggestions to improve header information

Current User-agent Header information	Improved User-agent Header Solution
• Details of the system • Platform the browser uses • Browser platform details	• Details of the system • Platform the browser uses • Browser platform Details • Browser size • Browser • Device hardware info (required) • User Location (if enabled) • Technical Details • HTML support, CSS Support, and JavaScript information

The current dependencies of devices, network and resources that are being broadcasted over the network has compiled us to send in more information to the server for them to handle it intelligently. One solution can be making the header information intelligent by sending not just information but the right information. By adding two basic information about the device can improve the User experience as well as better resource management for the servers via CDNs. Content Delivery Networks that resides on servers also needs a particular optimization technique to part the information send via user-agent. Yottaa a company expert in the Content Delivery Network technology that has introduced a solution for adaptive Content Delivery Networks, which uses its patent technologies to allow the rightful content to be delivered to its users along with security [20].

Google has already resolved the problem of the position of the resource with its technique of Art direction [19] but with this solution, the designers can be more focused on positioning the resource on the web rather than compressing, resizing and handling multiple resources. Youtube.com a partner to google uses client base rendering techniques to define how the video should be displayed on a device that depends on upon the user's network speed. It can also be solved when the same information is send using the user-agent technique. There is certain limitation to this technique

1) The user agent can be easily snooped and modified.
2) The user agent is sent to the server once per request which might compromise the dynamic nature of speed over the course of time.

This study is not focusing on providing the best solution for the issue but rather raising the awareness to the cause further research on this topic

3.2 Findings

Since 1990 when Tim Berners-Lee deployed his first prototype of Web based Website [11] it was based all on hypertextual information. The Web was started as a text based project, unlike today we are now using more and more of modern days' media elements such as Images, sounds, and videos in it. The applications and projects that were based on a simple desktop are now slowly shifting towards modern Web based solutions. This study has discussed a brief overview of the two major design patterns that are begin utilized in the Web and how they have their own pros and cons. Both fields of designing and developing are themselves a vast research domain which has their own perks and disadvantages. This study has discussed the problems that are being faced by the developers and the modern resources delivery mediums. However, the attempt was to define a fine line between the design patterns (i.e. Adaptive and Responsive web designs) and some major problems that the users and developers face on day to day.

Content Delivery Networks have been part of the technology for quite some time have been there for a quite long time in the technological history but still not much of positive research is being done on better content delivery. Content Delivery Networks are most commonly used for Delivering media objects over the web by sending over optimized resources like images, audio, video and etc. According to [7] Content Delivery Networks still lack the potential to deal mobile clients, which this study has pointed out and provided a simple solution how it can be solved. The solution is based on a simple concept of enhancing capabilities of the Content Delivery Network and as well as the header of the user-agent request so that right data could be delivered to its potential users without any hassle.

4. FUTURE WORK

Although there have been many massive upgrades for the Content Delivery Networks and newer generations have appeared from time to time. There's still a requirement needed for Content Deliver Networks to be responsive. Content Delivery Networks needs the ability to responsively send out information to its users by semantic request and response techniques. The content delivery should be made intelligent through request analysis through request headers and then the content needs to be either selected or processed.

This study has given suggestion to this problem via including more information about the users in the header for the server automate the response with the right content, it could be not the best one but the door is open to other solutions that may resolve one the major issues that the Web design industry is facing. Archimedes built the concept of the lever to gain the advantage of getting the work done earlier [21], machines make the work of humans easier and by allowing the Content Delivery Networks the ability to sense its user's request can not only help Web designers develop a better experience but these techniques can be applied to upcoming trends.

The role of mobile phones and tablets PCs will increase in upcoming years and there will be more utilization of network resources globally. There is a requirement for an optimized technique which will provide a solution.

The content is increasing on daily basis over the Internet and the quality of the content in terms of resources has also been increased. The content from the just text it has come to Video streaming, Images transfer, now WebGL support has brought Textures for 3d models, Maps textures for GIS, Audio streaming are some of the modern mediums. A solution that resolves the content delivery in an intelligent way and which is based on what user want and how does

them want is still required. This study has just raised the awareness and importance of why need an intelligent new system for content delivery and how to achieve it with a simple solution to it, the door is still open to many other solutions that may shape the future of the smart Web.

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